# Cross Disciplinary Approaches in Collaborative Research for a Sustainable Society

*Norzaini Azman, Mazlin Mokhtar and Ibrahim Komoo*
*Research Niche 'Regional Sustainable Development', Universiti Kebangsaan Malaysia, Malaysia*

## Introduction

Scientific advancement and modern development are obviously closely linked. Most progress has come from scientific research that resulted from basic research approaches, usually within single disciplines. The traditional role of research was thus to contribute to the advancement of development by generating knowledge with technological applications such as new information technologies, biotechnology and transport and energy-transforming technologies. In many cases, relevant research issues of great social importance such as environment, community well-being, cultural and natural heritage remain neglected because they have little commercial potential. However, the demand for integrated and cross disciplinary research has become increasingly important in recent years (Wasson and Dovers, 2005). Cross disciplinary research or integrative research arises from the widespread recognition that important societal questions and problems can no longer be adequately addressed within a single discipline and in fact, demand multidisciplinary and interdisciplinary conceptualisation and research solutions (Gibbons et al. 1994; Johnston, 1998). This approach is a consequence of the emergence of the multiple problems of modern development, particularly in relation to sustainable development issues.

This paper highlights some of the integrative and cross disciplinary approaches to research and development in the context of pursuing a sustainable society. This article reviews types of cross collaborative research used in knowledge production and a need for a research network that works closely together to identify, nurture and maintain *multi-*, *inter-* and possibly *trans*-disciplinary research interest.

## Defining Cross Disciplinary Research

There are many different terms used by researchers to describe collaboration processes within mono-discipline research teams with colleagues from other disciplines. Major terms often used are 'multidisciplinary', 'interdisciplinary' and 'transdiciplinary' research. These terms are often used interchangeably although they can mean different things within the research community.

In order to define and understand what is meant by cross disciplinary research, Table 1 below summarises the definitions of other forms of research collaboration in knowledge production. The main differences between the definitions of the concepts are the intensity of cooperation, integration of disciplines and the involvement of non-academic fields.

## Cross-disciplinary Approach and Sustainability

The aim of sustainable development is to overcome the separation between society and the biophysical environment, and between ecological, social and economic dimensions of development (World Commission on Environment and Development, 1990). In a sustainable society, all present and future generations are healthy and they have their basic needs met, have fair and equitable access to resources and a decent quality of life while the biological diverse ecosystems on which the society depends are conserved. Thus, in a sustainable society, environmental protection, economic objectives and social justice belong to a common framework. Achieving sustainable development requires the involvement of diverse areas of expertise and of wide stakeholder interests, including participants from scientists, civil society, the private sector and public agencies.

**Table 1: Definitions of types of research mode**

| Research Mode | Description |
|---|---|
| Disciplinary | Project that takes place within the bounds of a single, currently recognised academic discipline. |
| Multidisciplinary | Several different academic disciplines researching one theme or problem but with multiple disciplinary goals. Participants exchange knowledge, but do not aim to cross subject boundaries to create new knowledge and theory. The research process progresses as parallel disciplinary efforts without integration but usually with the aim to compare results. |
| Participatory | Academic researches and non-academic participants working together to solve a problem. The participants exchange knowledge, but the focus is not on the integration of the different knowledge cultures to create new knowledge. |
| Interdisciplinary | Several unrelated academic disciplines (involved) in a way that forces them to cross subject boundaries to create new knowledge and theory and solve a common research goal. |
| Transdisciplinary | Projects that both integrate academic research from different unrelated disciplines and non-academic participants, such as government policy makers, managers of private industries and the public, to research a common goal and create new knowledge and theory. Transdisciplinarity with a participatory approach. |

Most decisions about sustainability issues involve scientific information about the biophysical system, along with human values and benefits. Thus, to understand current issues or to predict sustainability outcomes requires an identification of the characteristics of resilient systems and it needs dynamical relationships between knowledge production, policy formation and decision making (Wasson and Unerdal, 2002). Many of the challenging issues in developing countries such as water, energy and waste management are those that occur at the interfaces between disciplines and therefore require integrative research and synthesis. Multi- and inter- trans-disciplinary research is needed within natural science and social science and humanities, and engineering and medical sciences working together to understand earth and human systems; or across research domains to deal with complex dimensions of sustainability issues.

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**Collaborative Research for Sustainability**

In several developed countries, there are high level strategies that have an integrated and collaborative research approach to sustainable development (Hilden, 2007). The same can be argued for developing countries although in truth, this approach is a more recent phenomenon and, for some Malaysian universities, the collaborative research approaches are in the process of being institutionalised. Increasingly, there is a trend among funding agencies having multiple disciplines collaborate on a research project because they believe this approach will result in greater insight and creativity for researchers attempting to solve complex problems. This interconnectivity between disciplines and the resultant insights into problem solving is appreciated, unfortunately academic departments have not been set up to facilitate interdisciplinary research in the most supportive and effective ways possible. In Universiti Kebangsaan Malaysia (UKM), a more problem oriented approach in the form of integrative research is being promoted rigorously since 2007. Consequently, multi, inter and transdisciplinary research approaches are increasingly introduced, for instance in developmental projects. Collaborative research is not something new and has been initiated from the late 1990s but it has taken nearly ten years before it is now broadly acknowledged in Malaysia.

**Challenges for University Research**

Responding to the requirements of multidisciplinary and trans-disciplinary research poses great challenges to research institutions particularly research centres and institutes in universities. Universities have traditionally been organised in a disciplinary way, with broader units encompassing similar disciplines, grouped in faculties. As a consequence, multidisciplinary research institutes seldom receive full acknowledgement as part of university education because the right to grant Masters and PhD degrees is still reserved for the traditional faculties. Although the scenario has changed in Malaysian universities, the situation is still noticeably unchanged in some other developing countries.

In addition, promotion, tenure and salary decisions are evaluated on scholarly contribution to the field of expertise, especially based on, publication history with single author publications ranked the highest (Hart, 2000). Furthermore, a pervasive attitude that has existed in most university cultures, that is, researchers should remain loyal or true to their original discipline is another hindrance to collaborative research. In many instances, researchers are encouraged to work within their original disciplinary paradigm and use the methods and knowledge gained during their initial education and training experiences. Many times, departments do not view the use of alternative paradigms and methods of enquiry favourably.

Despite these concerns, many scholars suggest that collaborative approach is now more prominent in university research (Endersby, 1996; Smith and Katz, 2000). Research in fields of natural science, education and technology frequently require access to resources, comparative data and funding. All of these requirements are most easily secured via collaborative research. Indeed, academics involved in collaborative research have been found to be very successful in accessing resources which has in turn enabled them to realise the epistemic goals of sciences more effectively than scientists outside the university environment, thus creating a research environment in which collaboration is now the norm (Wray, 2002).

**Traditional Approach in University Research**

University research traditionally has always been initiated by the need to advance knowledge in disciplinary based issues and to support the teaching and training in the respective disciplines. For this reason, most of the research activities conducted by Malaysian academics fall under the following purposes:

- Discipline driven – extension of academic training which is related to the research carried out during the Master and Doctoral programme;
- Knowledge advancement driven – short-term and long term research activities to strengthen knowledge-based for the glory to the discipline;

- Curriculum driven – usually to support teaching and training needs, particularly for relatively new fields; and
- Peer group oriented – several academics within the same disciplinary base work for a common goal in the areas of common issues or problems or frontier research.

Even though the need for disciplinary-based research is crucial for the advancement of knowledge to fill gaps and to explore frontier domain, the purpose is becoming less obvious for solving current societal, economic and environmental issues related to sustainable development. Disciplinary based approach in problem solving has been seen as one of the obstacles to implement multi-sector solutions. So much so that academics with their *mono* disciplinary knowledge have been seen as no longer relevant to the need of the society.

**Shifting Paradigm towards Future Research**

A current and future major societal issue such as environmental degradation, sustainable resource utilisation, climate change and socio-economic development of local community has always been associated with multiple sector issues and require cross disciplinary solution. In responding to these cases, the need for multi-, inter- and/or trans-disciplinary approaches in research has become more pertinent. University academics have inevitably shifted their paradigm toward research idea taking into consideration the following scenarios:

- Approach – should be cutting edge research for cross cutting issues;
- Purpose – emphasis toward problem solving that is multi-dimensional, scale and level;
- Drivers – shifts from specific research problems to national priorities, development targets and global commitments;
- Direction – priority should be given to the present and future research needs;
- Requirement – understanding stakeholders' needs; understanding researchers' capacities and capabilities; and understanding interconnectedness and inter-linkages of research issues and their solutions.

Future research cannot be carried out purely by a single disciplinary group. There is a need to build a team or teams of multi-disciplinary components which is/are complementary in providing their knowledge or information for common goals. Future research require researchers and university administrators' ability to cross the boundaries of departments and faculties, and appreciate the need to have research leaders who can visualise and conceptualise the complex issues involved, and at the same time, be able to attract the appropriate talents from various disciplines to work as a team. Some of the possible challenges, one might anticipate for these research leaders and their team are likely to be on how to bridge their collectives disciplines, the balancing act between individual inputs and teamwork, openness to develop new approaches and methodology, strategic mainstreaming of individual contribution and system barriers, and flexible funding and support system. The success of cross disciplinary research is likely to depend mainly on the ability to maintain the shared value and cohesiveness of the research team rather than the actual research activities *per se*.

**Concluding Remarks**

Universities have an essential role to play in promoting research that supports efforts to ensure that economic growth and sustainable development reinforce each other. In addition, universities have a key role in providing education and training that equip the qualified workforce with the necessary competences to fully develop and exploit sustainability.

Research into sustainable development must include short term decision support projects and long-term visionary conceptual projects and has to tackle problems of a global and regional nature. It has to promote inter-and trans disciplinary approaches involving social and natural sciences and bridges the gap between science, policy making and implementation. Universities should contribute through multi, inter and trans disciplinary research by involving academia, industry and policy makers to advance the development of a sustainable society.

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